Wellcome Trust Vacation Bursary Scheme Summer 2024

Supervisors and projects

- **Michael A Stone** - Measuring access to acoustic spectral-temporal modulations by human hearing
- **Rathi Ravindrarajah** - Mental health outcomes and utilization of mental health care services in ageing adults in primary care - a systematic review
- **Rebecca Millman** - Improving the accessibility of speech used in broadcast for people with hearing loss

Measuring access to acoustic spectral-temporal modulations by human hearing

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Research profile: Michael A Stone
Other information: Garreth Prendergast

Human-audible sounds vary dynamically in the dimensions of level (intensity), time (temporal) and frequency (spectral). Many sounds combine variation in all three dimensions. These variations are called modulations. The brain interprets the modulations of a sound to convey meaning, such as in speech.

Modulations have a unique property in that they cannot exist without a carrier. In speech this carrier is either voicing produced by the larynx contributing to vowels, or the rasping of exhaled air at a constriction in the vocal tract contributing to consonants. The modulations are produced by the movement of the "articulators", tongue teeth and lips changing the frequency content of the carriers.

It has long been known that the auditory system can transform an otherwise steady carrier into a modified carrier but with re-generated modulations. Previous work by the PI/Supervisor has shown that the re-generated modulations are a major disruptor of speech intelligibility in the presence of a background noise. This situation is common to many listening situations.

Previous measures of spectral-temporal modulations have been confounded by not taking into account the influence of the carrier-generated modulations. This project proposes to re-measure human responses to spectral-temporal modulations in the conventional (wrong) way, so as to compare with a new way that near-eliminates the influence of the carrier modulations. Small control experiments will be needed in order to rule out possible confounds that can accidentally be introduced by new methods.

This topic is important for guiding the design of good communication systems such as in broadcast and telephony. Signal processing used in these systems may damage the reduced range of modulations that are accessible due to the adverse effects of age or hearing-impairment. The study fits well under the Wellcome remit of "fundamental processes that underpin biology, to understand more about how human life works".

Mental health outcomes and utilization of mental health care services in ageing adults in primary care - a systematic review

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Advances in healthcare have lengthened lifespans for many millions of people. Health services, and particularly primary care face a major challenge in how best to provide high quality and appropriate care to older individuals. This stage of life is associated with stressful life events such as bereavement, loneliness, co-morbidities, frailty, and financial hardships that can affect mental health. Poor mental health in older adults is accepted as part of ageing by older adults as well as physicians who treat them.

However, evidence suggests that this group are not prioritised for non-pharmacological treatments in primary care. Older adults may be missing out on the benefits of psychological therapy and there are potential harms associated with polypharmacy such as an increased risk of falls.

The inequality in accessing mental health care services by older adults has been acknowledged in the NHS long-term plan and the NHS Mental Health Implementation Plan for 2019/20-2023/24.

A key goal is equal access to mental health care to all patients regardless of their age. The COVID-19 pandemic has also exacerbated health inequalities as well as changed the way care was delivered from face-to-face to other digital means.

The student will contribute to the conduct of knowledge synthesis by conducting a systematic review on the mental health care for older adults in primary care to provide a summary of the evidence discovered so that informed, evidence-based conclusions can be drawn to justify the need for further research.

Improving the accessibility of speech used in broadcast for people with hearing loss

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Background

Understanding the speech used in television and radio ("broadcast speech") can be challenging, particularly for people who have a hearing loss and wear hearing aids.

A number of factors contribute to the intelligibility of broadcast speech, including speech clarity, unfamiliar or strong accents used by actors/presenters and background sounds. To resolve the accessibility issues associated with broadcast speech for people with hearing loss, we need to address not only the intelligibility of broadcast speech but also the individual's experience of the mental effort (listening effort) needed to understand it.

We will use the BBC's online platform to gather data whilst participants who wear hearing aids are watching BBC content in their own homes. We will identify examples of BBC broadcast that our participants find difficult to understand and analyse these examples to understand why this content was challenging. Participants will be asked to answer questions about how well they understand the content, provide subjective ratings of their listening effort and also report on relative contributions of the factors "clarity", "accents" and "background sounds" to their listening effort.

Aims

To use content broadcast by the BBC and find out what makes broadcast speech less intelligible and more effortful for participants who wear hearing aids.

Objectives

- Recruit participants with hearing loss into the study.
- Use the BBC online platform to acquire measures of speech intelligibility and listening effort associated with BBC broadcast.

- Analyse participant responses to determine which factor(s), including “clarity”, “accents” and “background sounds”, resulted in the lowest speech intelligibility and/or the most listening effort.
- Determine which factor(s) should be the focus of future work to improve the accessibility of broadcast speech for people with hearing loss.

- Visits to Media City in Salford will be encouraged to facilitate liaison with the BBC Audio R&D team.